

## CLAIMS

What is claimed is:

- 1        1.        A method for detecting the presence of at least one selected strain of an  
2        organism in a sample, comprising the steps of:  
3                providing a sample that may comprise nucleic acid from at least one selected  
4        strain of an organism and nucleic acid from at least one non-selected strain of the  
5        organism;  
6                providing a plurality of primers substantially complementary to regions of  
7        both said nucleic acid from at least one selected strain of the organism and said  
8        nucleic acid from at least one non-selected strain of the organism;  
9                exposing said sample to at least one probe that is sufficiently complementary  
10       to a portion of said nucleic acid from at least one non-selected strain to block full  
11       length amplification of said nucleic acid from at least one non-selected strain  
12       between said plurality of primers, said at least one probe comprising a nucleic acid  
13       analog;  
14                amplifying said nucleic acid from at least one selected strain between said  
15       plurality of primers; and  
16                detecting amplification product of nucleic acid from at least one selected  
17       strain.
- 1        2.        The method of claim 1, wherein said at least one selected strain comprises a  
2        pathogenic strain.
- 1        3.        The method of claim 2, wherein said sample is derived from a subject and  
2        said pathogenic strain indicates a risk of cancerous growth in said subject.
- 1        4.        The method of claim 1, wherein said organism comprises human papilloma  
2        virus (HPV).
- 1        5.        The method of claim 1, wherein said at least one probe comprises PNA.

- 1 6. The method of claim 5, wherein said at least one probe further comprises a  
2 nucleotide different from PNA.
- 1 7. The method of claim 1, wherein each of said at least one probe comprises at  
2 least 8 bases.
- 1 8. The method of claim 1, wherein the step of amplifying said nucleic acid of at  
2 least one selected strain between said plurality of primers comprises conducting a  
3 reaction selected from the group consisting of a polymerase chain reaction, a ligase  
4 chain reaction, a rolling circle replication, a branched chain amplification, a nucleic  
5 acid based sequence amplification (NASBA), a Cleavase Fragment Length  
6 Polymorphism, ICAN and RAM .
- 1 9. The method of claim 4, wherein said regions of both said nucleic acids are  
2 parts of a region selected from the group consisting of L1, L2, E1, E6, and E7 region.
- 1 10. The method of claim 4, wherein said at least one non-selected strain equals  
2 all the low-risk HPV strains known.
- 1 11. The method of claim 4, wherein said at least one non-selected strain is  
2 selected from the group consisting of HPV strains 6, 11, 42, 43, and 44.
- 1 12. The method of claim 4, wherein said at least one selected strain comprises a  
2 plurality of high-risk HPV strains.
- 1 13. The method of claim 4, wherein said plurality of primers comprise MY09 and  
2 MY11 (SEQ. ID. NOS. 10 and 11).
- 1 14. The method of claim 4, wherein said at least one probe is selected from the  
2 group of sequences consisting of SEQ. ID. NO. 6 and SEQ. ID. NO. 7.
- 1 15. The method of claim 1, wherein said sample is a cervical scraping.

1 16. The method of claim 1, wherein said step of detecting amplification product  
2 comprises in-gel electrophoresis of said product and staining said product with  
3 ethidium bromide.

1 17. A method for detecting the presence of a target nucleic acid of a human  
2 papilloma virus (HPV) in a sample cell, comprising the steps of:  
3 suspending a sample cell in a solution;  
4 isolating a target nucleic acid of a HPV from said sample cell;  
5 contacting said target nucleic acid with at least one probe comprising peptide nucleic  
6 acid (PNA), said at least one probe being substantially complementary to portions of  
7 nucleic acids of multiple HPV types; and  
8 detecting hybridization between said at least one probe and said target nucleic  
9 acid.

1 18. The method of claim 1, wherein said solution contains an alcohol in an  
2 amount sufficient to fix sample cells without coagulation, an anti-clumping agent,  
3 and a buffer agent that maintains the solution at a pH within a range of about 4 to  
4 about 7.

1 19. The method of claim 1, wherein said sample cells come from a subject and  
2 wherein the presence of said target nucleic acid sequence indicates a risk of tumor  
3 growth in said subject.

1 20. The method of claim 4, wherein said tumorous growth is associated with  
2 either cervical cancer or endocervical carcinoma.

1 21. The method of claim 3, wherein the presence of said target nucleic acid  
2 sequence is indicative of the presence of a particular type of HPV.

1 22. The method of claim 7, wherein said particular type of HPV is selected from  
2 the group consisting of types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68 and 70.

1 23. The method of claim 3, wherein absence of said target nucleic acid sequence  
2 is diagnostic of absence of infection by HPV.

1 24. The method of claim 3, wherein absence of said target nucleic acid sequence  
2 is diagnostic of absence of infection by HPV types selected from the group  
3 consisting of types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68 and 70.

1 25. The method of claim 1, wherein absence of said target nucleic acid sequence  
2 is diagnostic of absence of infection by high-risk types of HPV.

1 26. The method of claim 1, further comprising amplification of said target  
2 nucleic acid.

1 27. The method of claim 12, wherein said amplification step comprises  
2 conducting a polymerase chain reaction.

1 28. The method of claim 1, further comprising capturing said target nucleic acid  
2 onto a solid support through PNA-DNA interaction.

1 29. The method of claim 1, wherein each of said at least one probe comprises at  
2 least 8 bases.

1 30. The method of claim 1, wherein said at least one probe comprises a  
2 nucleotide different from PNA.

1 31. The method of claim 1, wherein said at least one probe is selected from the  
2 group consisting of SEQ. ID. NOS. 1-5.

1 32. The method of claim 1, wherein said at least one probe is labeled with a  
2 detectable marker.

1 33. The method of claim 17 wherein said at least one probe comprises a  
2 molecular beacon probe.

1 34. The method of claim 1, further comprising using an antibody to recognize  
2 said hybridization.

1 35. A method for detecting the presence of a target nucleic acid of a human  
2 papilloma virus (HPV) in a sample, comprising the steps of:  
3 capturing candidate nucleic acids that include a target nucleic acid on a solid  
4 support;  
5 contacting said candidate nucleic acids with at least one probe comprising  
6 peptide nucleic acid (PNA), said at least one probe being substantially  
7 complementary to portions of nucleic acids of multiple HPV types; and  
8 detecting hybridization between said at least one probe and a target nucleic  
9 acid.

1 36. The method of claim 20, wherein capturing candidate nucleic acids  
2 comprises DNA-DNA interaction.

1 37. A method for in situ detection of the presence of a target nucleic acid of a  
2 human papilloma virus (HPV) in a sample, comprising the steps of:  
3 transferring suspended sample cells uniformly onto a surface;  
4 in situ hybridizing a target nucleic acid of a HPV contained in said cells with at  
5 least one probe comprising peptide nucleic acid (PNA), said at least one probe being  
6 substantially complementary to portions of nucleic acids of multiple HPV types; and  
7 detecting hybridization between said at least one probe and a target nucleic  
8 acid.